Abstract

Problem: Although extreme poverty is being eradicated effectively, people in developing countries continue to struggle to meet their basic needs. At the same time a new class of poor people is emerging in Western developed countries, the working poor, who struggle with decades of stagnating wages and rising living costs.

Money is created as debt and as the poor have no means to repay the debt, commercial banks are less interested in providing services to the poor. Accordingly, around half of the population in developing countries do not have a bank account. In South Asia and Sub-Saharan Africa this portion is even larger. Many people don't have electricity either, but they do have mobile phones.

In Africa for example, people with mobile phones outnumber those with electricity, even though many have to walk long distances to recharge their batteries. The number of smartphone users worldwide is expected to grow by one billion in a time span of five years. In 2019 there will be 2.7 billion smartphone users in the world.

NO MONEY = NO BANK ACCOUNT = NO CREDIT CARD = NO CRYPTOCURRENCY

Solution: Using the asset that people have, mobile phones, OecoSystema provides low-income people access to a fairly distributed cryptocurrency for exchanging goods and services. Each user receives 50 utility tokens upon registration for use as payment. The value of the tokens is based on the value of the goods and services exchanged in the network.

Users cooperate on the local level to save money, share value and create a stronger community. The tokens and the marketplace app are used as a tool to improve quality of life. Cellphone users are the majority of mobile phone users in developing countries and OecoSystema enables SMS transactions. A network of local agents are incentivized to register, educate and support cellphone users, as well as organize physical village markets.

SMARTPHONE = CRYPTOCURRENCY + MARKETPLACE APP

CELL PHONE = CRYPTOCURRENCY + VILLAGE MARKET
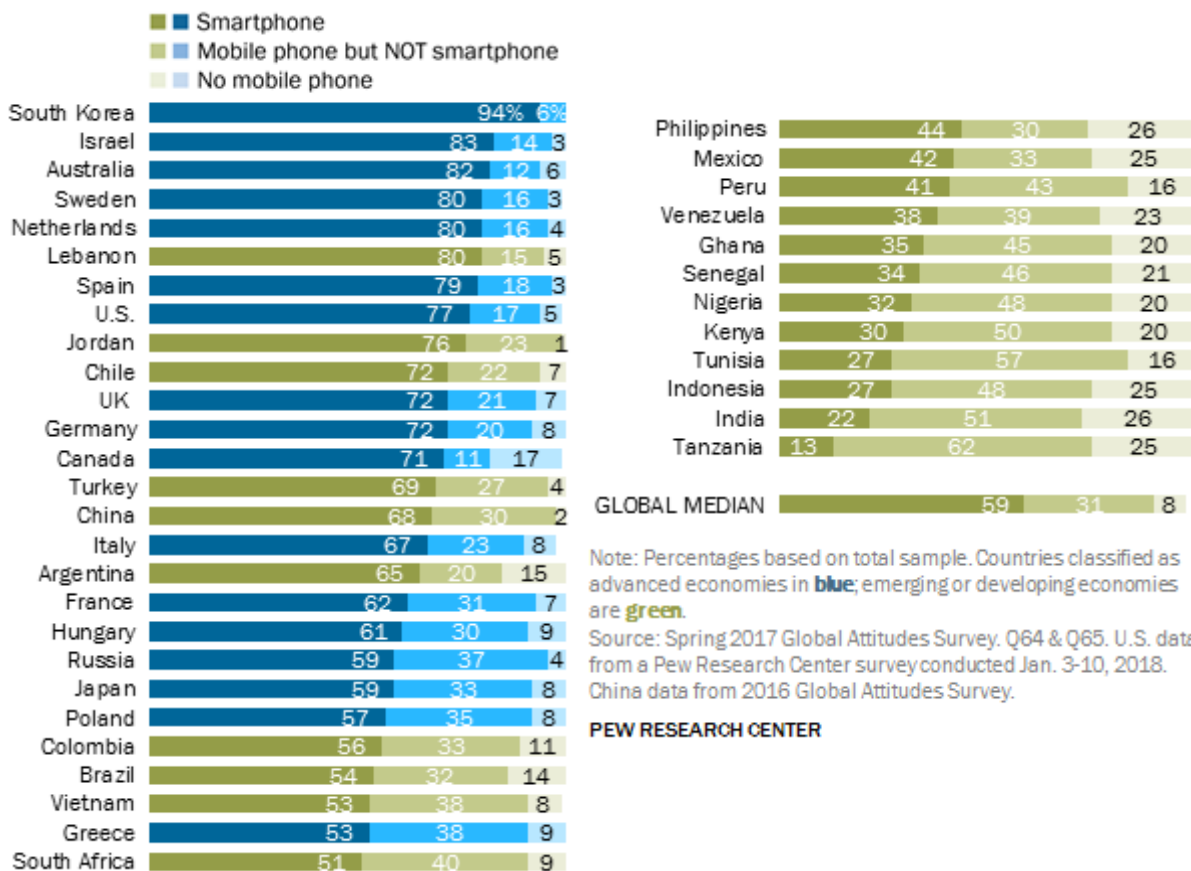
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Market Overview

The positive socio-economic effects associated with Internet access and use are well documented. Governments across the world have sought to promote national development goals by increasing broadband access.

Mobile Phones and Mobile Money

Internet use is concentrated on mobile phones in both developed and developing economies. The global median for smartphone penetration is 59% in 2017, with a rapid rate of increase especially in developing countries. In developed countries 70% of internet access is from smartphones.

Kenya for example has a relatively developed mobile phone market, but still around 50% of the population has a cellphone and 20% no mobile phone at all. Still a 30% penetration of smartphones provides internet access to a very large number of people in Kenya.

Even in the least-developed nations, mobile phone penetration is at 70% per cent and rising. Developing nations typically have a young population and millennials (ages 18 to 34) are much more likely to be internet and smartphone users compared with those ages 35 and older. This significant age gap does appear in both advanced economies and among emerging and developing nations. Younger internet users also tend to access the internet at least daily and participate in social networking at higher rates than their older counterparts.

Legend:
- Smartphone
- Mobile phone but NOT smartphone
- No mobile phone

Country	Smartphone	Mobile phone but NOT smartphone	No mobile phone
South Korea	94%	6%	
Israel	83	14	3
Australia	82	12	6
Sweden	80	16	3
Netherlands	80	16	4
Lebanon	80	15	5
Spain	79	18	3
U.S.	77	17	5
Jordan	76	23	1
Chile	72	22	7
UK	72	21	7
Germany	72	20	8
Canada	71	11	17
Turkey	69	27	4
China	68	30	2
Italy	67	23	8
Argentina	65	20	15
France	62	31	7
Hungary	61	30	9
Russia	59	37	4
Japan	59	33	8
Poland	57	35	8
Colombia	56	33	11
Brazil	54	32	14
Vietnam	53	38	8
Greece	53	38	9
South Africa	51	40	9

Country	Smartphone	Mobile phone but NOT smartphone	No mobile phone
Philippines	44	30	26
Mexico	42	33	25
Peru	41	43	16
Venezuela	38	39	23
Ghana	35	45	20
Senegal	34	46	21
Nigeria	32	48	20
Kenya	30	50	20
Tunisia	27	57	16
Indonesia	27	48	25
India	22	51	26
Tanzania	13	62	25
GLOBAL MEDIAN	59	31	8

Note: Percentages based on total sample. Countries classified as advanced economies in **blue**; emerging or developing economies are **green**.
Source: Spring 2017 Global Attitudes Survey. Q64 & Q65. U.S. data from a Pew Research Center survey conducted Jan. 3-10, 2018. China data from 2016 Global Attitudes Survey.

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Socio-Economic Impact

Internet access effects both economic growth as well as social and political inclusion. A 10% increase in broadband penetration increases GDP by 1.38% in developing economies. The internet lowers information costs and creates more efficient markets. Through inclusion, existing markets can be expanded at a low cost, be it in trade or government services.
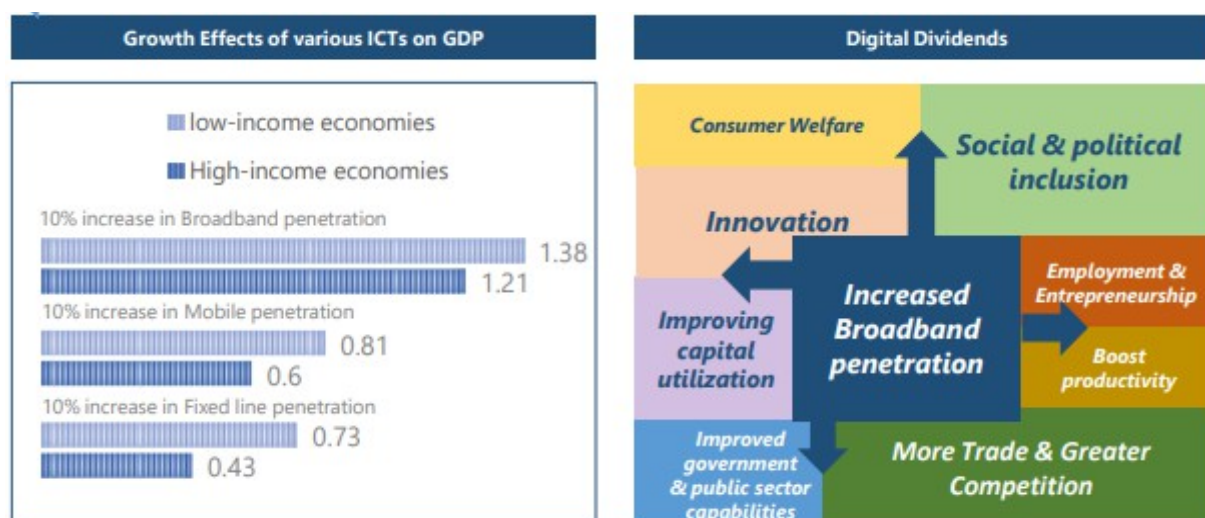
Source: The Commonwealth Telecommunications Organisation

The internet helps overcome information and communication problems. There are three mechanisms through which information increases productivity:

1. A mutually beneficial transaction does not take place because when the two parties have no information of each other.

2. Transactions that already take place are made faster, cheaper and more reliable.

3. Two parties have asymmetric information of each other. For example a bank wanting to provide credit to a farmer often can not do so as there is no credit history on which to to base the loan decision.

Mobile phones are being used in a range of innovative ways for example to increase revenue and avoid throwing perishable goods away. For example fishermen and farmers use them to obtain information on market stocks and prices before deciding in which market to sell their produce. New e-commerce and sharing-economy models, including ridesharing and employment matching are appearing and scaling quickly in the developing world.

In insurance products, combining satellite imagery with information received from a farmer concerning crop failure due to no rain, enables insurance payments to be released directly on to the mobile phone within a very short time frame. Public services can also be offered directly to citizens at low cost.

Mobile Phones as Bank Accounts

The most common reason people cite for not having a bank account is not having enough money. There are also large numbers of people who lack an official identity document.

Accordingly the majority of mobile subscriptions (95% across Africa) are based on prepaid SIM cards and 92% of all prepaid SIMs are active in countries where SIM registration is mandatory. Yet 90% of countries mandating prepaid SIM registration do not enable MNOs to validate their customers' identification credentials against a central government database to check the accuracy.

When registered mobile phones are used for financial transactions, a digital trail is documented which can be used for credit decisions with an established identity. Providers can also use mobile technologies to issue, monitor, and collect payments on the loans they extend, reducing costs and thus enabling extension of smaller loans.

Mobile network operators often cooperate with banks as they provide a direct payment channel through the prepaid SIM cards and their networks of agents. As an alternative, direct carrier billing and premium SMS allow certain business models to become viable.

A range of mobile money value-chain models exists.
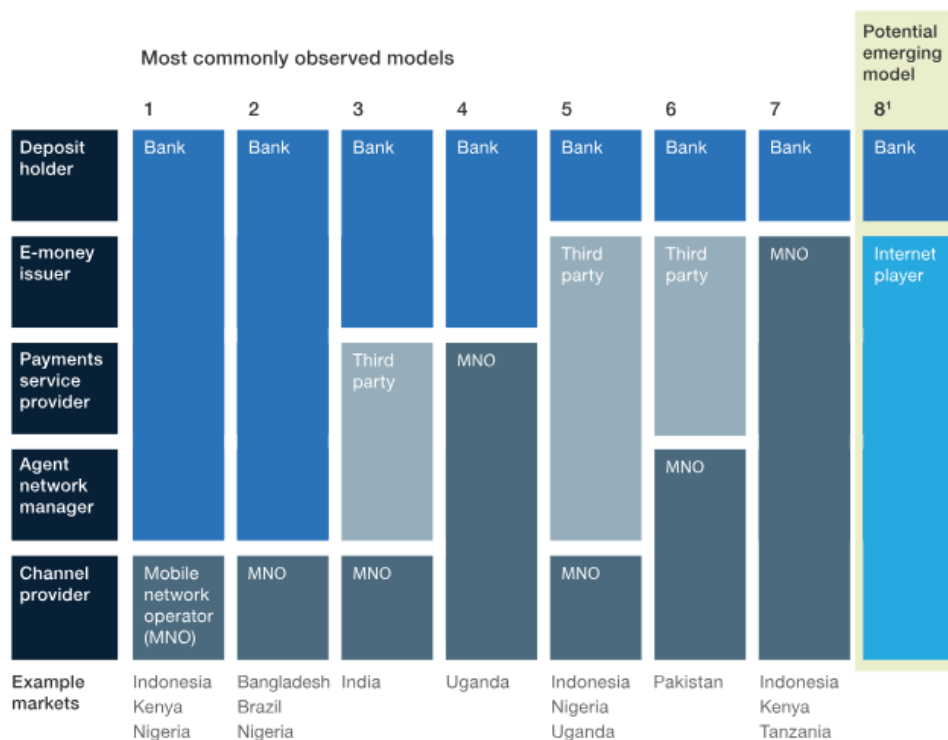
Source: McKinsey, The-Business Case for Financial Inclusion

Example: M-Pesa in Kenya

M-Pesa (M for mobile, *pesa* is Swahili for money) is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom and Vodacom, the largest mobile network operators in Kenya and Tanzania. It has since expanded to Afghanistan, South Africa, India, Romania and Albania. M-Pesa allows users to deposit, withdraw or transfer money and pay for goods and services with a mobile device. Users are charged a small fee for sending and withdrawing money using the service. M-Pesa is a branchless banking service with a network of agents that includes airtime resellers and retail outlets acting as banking agents.

Originally M-Pesa gained popularity as a cheap way for urban migrants to transfer remittances to their families in the countryside. Today it is being used to buy goods and services, and pay bills to utilities, insurance companies and microfinance lenders. Although M-Pesa does not pay interest, the accounts are still used as savings accounts as it is more secure than cash, cattle, gold or neighbohood savings schemes. The funds are deposited in several commercial banks, which are regulated by the Central Bank of Kenya. The funds are held by a Trust and cannot be accessed by Safaricom. In case of a bankruptcy the customer funds in M-Pesa remain the property of the M-Pesa users.

The M-PESA cash merchants or agents pre-buy mobile money so that they can sell it against cash to the customers who come to their retail store for cash-in operations. Agents invest their own working capital and are not intermediating third party funds. For cash-out operations, they sell their cash and buy mobile money instead. Cash merchants have with no more access to the M-PESA platform than any other customers, except that they have higher transaction limits. There is a three-factor authentication for cash-ins and cash-outs, having the SIM card, having your ID and knowing the PIN.

According to some studies, families using M-Pesa have experienced a 5% to 30% increase in household income. Access to M-PESA increased consumption levels over a six-year period, enabling an estimated 186,000 families, or as many as 2 percent of Kenyan households, to move out of poverty. The impact on female-headed households was more than twice the average measured. The difference was simply the ease of sending and receiving money, not higher level financial products such as loans or micro-insurance.

M-PESA is the mechanism through which financial inclusion is delivered, not the intermediary.

Old and New Poverty

In its original meaning „ekonomos" was the activity a household engaged in for the purpose of meeting its members' basic needs; it was not connected to the idea of financial investment or financial profit.

Today it remains difficult for most people in developing countries to meet their basic needs and in developed countries new forms of poverty have emerged.

The Nouveau Poor in Developed Countries

The last financial crisis left 60 million people in the US receiving food stamps and homelessness is a growing problem. In San Francisco for example, a court ruling recently classified the homelessness crisis in the city to be a human rights violation.

In Europe youth unemployment in Southern Europe remains above 50%. The problems created by the financial crisis have not been fixed and the former currency devaluation model used by Southern European countries to restore their economic balance is no longer possible under EU laws and the Euro.

In all Western countries decades of stagnating wages, rising living costs and especially the housing bubbles in cities, make it difficult for working people to survive. In the US for example:

- Real wages are lower today than in 1973
- Nearly 80% of workers live from paycheck to paycheck
- Over 60% of jobs do not support a middle class
- 140 million people are either poor or low-income
- 50% of the elderly have no retirement savings

Looking into the future with automation and robots rendering entire job classes redundant and probable further financial crises due to the excessively high levels of sovereign, corporate and household debt, the new class of poor people may grow significantly.

Poverty in Developing Countries

"Poverty is a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information. It depends not only on income but also on access to services. In 2018, "extreme poverty" widely refers to making below the international poverty line of $1.90/day (in 2011 prices, equivalent to $2.07 in 2017), set by the World Bank. The vast majority of those in extreme poverty – 96% – reside in South Asia, Sub-Saharan Africa, The West Indies, East Asia and the Pacific; nearly half live in India and China alone. As of June 2018, Nigeria became the poverty capital of the world with more than 86 million of its citizens living in extreme poverty despite abundant resources".

- Wikipedia

In most developing countries poor people report working multiple jobs in order to get their income, typically one agricultural and one non-agricultural. Most non-agricultural jobs involve self-employment as a business owner. Typically, a member of the poor household will migrate (about 60% of families) to a city or a job in the natural resources sector. Others will perform a

job earlier in the day, like selling food, and then go out and perform another job, like selling textiles, collect trash, or general labor. Additionally, most poor families report at least one member of their household working for a public employment program. Many governments provide safety-net "food for work" programs, which entitle some days of physical labor under government employment at a pre-announced low wage.

The poor generally don't own many productive assets either, but some do have land, although small in size (around 1 hectar) and most of this land being dry scrubland that cannot be used for agriculture throughout most of the year. Other goods that could be used for productivity are in short supply. Less than 14% of poor households own a bicycle and less than 1% of poor households have sewing machines, a bullock cart, a motorized cycle, or a tractor. Houses are typically basic huts.

Since the 1960's the dominating way to to help poor people in developing countries has been through foreign aid. Humanitarian foreign aid seemed to offer the world a new hope for fighting evil without fighting a war. More recently studies have been made on the effectiveness of this aid.

Angus Deaton won the Nobel prize in economics for his studies of poverty in India and South Africa and how the poor decide to save or spend money. His ideas about foreign aid are provocative. Deaton argues that, by trying to help poor people in developing countries, the rich world may actually be corrupting those nations' governments and slowing their growth. The money handed out doesn't reach the population effciently.

One contributing factor is that economists have widely believed the key to triggering growth in any economy was pumping money into a country's factories, roads and other infrastructure. So in the hopes of spreading the Western model of democracy and market-based economies, the United States and Western European powers encouraged foreign aid to smaller and poorer countries that could fall under the influence of the Soviet Union and China. Today it is China who is most active in combining trade deals in Africa with infrastructure build-outs.

The United Nations measures poverty through the multidimensional poverty index (MPI). The MPI looks beyond income to understand how people experience poverty in multiple and simultaneous ways. It identifies how people are being left behind across three key dimensions: health, education and standard of living, comprising 10 indicators. People who experience deprivation in at least one third of these weighted indicators fall into the category of multidimensionally poor. There are over 1.3 billion multidimensional poor in the world, and 1.1 billion of those live in Sub-Saharan Africa or South Asia. The 10 indicators are:

- Health: Nutrition / Child Mortality
- Education: Years of Schooling / School Attendance
- Standard of Living: Cooking Fuel / Sanitation / Drinking Water / Electricity / Housing / Assets

The Money Problem

"A constant in the history of money is that every remedy is reliably a source of new abuse".
- John Kenneth Galbraith, Money: Whence it Came, Where it Went

Money has always existed as either debt-based accounting systems or based on precious metals or other valuable items in order to avoid direct barter. The current fiat money system is a debt-based accounting system where 97% of new money is created by commercial banks as debt. As poor countries and poor people in general have no collateral nor any means to repay debt, commercial banks are less interested in serving the poor. This shortage of money to pay wages and basic consumption needs among the poor is not a new issue.

Local Notes and Coins in the Industrial Revolution

"In Great Britain, a shortage of small denomination coinage had been reported as early as the late 14th century. Such a shortage made it difficult for workers to be paid, and for transactions of daily life to be carried out. The shortages persisted and worsened through the late 17th century and became particularly problematic by the middle of the 18th century. The shortage of small denomination coinage reached a critical mass with the move of many workers away from agricultural jobs and into the work force in factories during the Industrial Revolution".

- Monneta.org

The shortage of silver and copper coins created the need to legalize local paper money for finance. Population growth and counterfeit coinage aggravated the situation. The industrial revolution was essentially financed with the issuance of local tokens and notes by private companies (e.g. cotton mills), merchants and entrepreneurs. The amount of local money soon exceeded the amount of metal coinage.

Some local companies created "truck shops" at which their workers were forced to buy overpriced goods with the tokens their employers had created. Some local banks on the other hand created worthless paper notes and then disappeared, leaving their creditors with nothing. The abuses of local money creation eventually led to calls for reform and national legal tender money was established, where the government was given monopoly control of money creation.

The local tokens often reflected arts and values in society:

Legal tender and the power of taxation go hand-in-hand. An example from the past is the colonial hut tax in Africa, a time when the colonial powers' monetary systems were mostly coin-based. Before the colonial currencies and the jobs associated with them, small communities in Africa relied on direct barter or local systems of indirect barter, where the measure of value was often something other than a metal coin (gold, silver, copper). The hut tax was introduced on a per hut or household basis. It was variously payable in money, labour, grain or stock and benefited the colonial authorities in four related ways: it raised money, it supported the currency, it broadened the cash economy aiding further development and it forced Africans to labour in the colonial economy. Households which had survived on cattle ranching now sent members to work for the colonialists in order to raise cash with which to pay the tax.

Microfinance and Local Currencies

In developing countries, the lack of a bank account does not necessarily preclude borrowing since people borrow more informally, from family, friends or stores on credit. Many people also become victims of loan sharks demanding high interest rates.

Microfinance

In the 1970s, Muhammad Yunus of Grameen Bank pioneered the idea that microfinance—small loans to poor, high-risk individuals—could enable people to pursue activities that would not only sustain their livelihood but also bring their families out of poverty. This is an area where traditional commercial banks cannot provide financial services profitably. Over time the terms have evolved – from micro-credit to micro-finance, and now financial inclusion.

The impact of microcredit is a subject of much controversy. Proponents state that it reduces poverty through higher employment and higher incomes. Critics on the other hand say that microcredit has not increased incomes, but has driven poor households into a debt trap, in some cases even leading to suicide. They add that the money from loans is often used for durable consumer goods or consumption instead of being used for productive investments. Despite the efforts of microfinance, nearly half of the adult population in developing countries does not have access to bank accounts or banking on a mobile or other device.

Microfinance does extend the debt-based fiat accounting system to the poor. The problem is that even if someone is able to buy a goat and sell its milk, there is not enough money circulating in the local economy to purchase the milk, even if there is demand for the product. Consumption cannot be based on debt alone.

Regional Currencies

Regional currencies attempt to cover the lack of circulating money as a form of complementary currency, an agreement within the community of a region to accept something other than legal tender as a means of payment. It connects unused resources with unmet needs at the local level. In developing countries regional currencies are more a way of life. Examples of regional currencies include WIR Bank in Switzerland and Chiemgauer in Germany. In Brazil a solution was created for the special needs of the Favelas, Banco Palmas. In a developing country, a regional currency helps fill the gaps left by the fiat monetary system and stabilise the whole system because of its countercyclical action.

Banco Palmas is an initiative of local currency and microcredit which has been practiced since 1998 at the Palmeira neighborhood in Fortaleza, Brazil. Ashoka Fellow João Joaquim de Melo Neto Segundo founded Banco Palmas as a strategy to address a larger cycle of poverty and stalled economic growth as a result of the lack of credit in poorer regions. This bank provides small-amount loans not in real, Brazil's official currency, but in palma which circulates only

within this neighbourhood. The parity (1 palma = 1 real) makes it easier for businesses to use and accept this currency. Credit cards as well as loans for house reforms are given to some users too. For each Palma in circulation, one Real is held in reserve by the association. Since the currency is good only within the boundaries of the neighborhood, borrowers tend to spend these resources on local purchases. As a result, this generates positive effects in the local economy. Credit offered by the Palmas Bank does not require documents, or any registered guarantees. Rather, neighbors vouch for the person receiving credit, giving assurances that the person is responsible and has experience in the intended field of activity.

The founding of Banco Palmas in Brazil is also a good example of the tensions between a fiat currency and an adjunct regional currency. After issuing the first Palmas currency in 2003, local organiser Joaquim Melo was arrested on suspicion of running a money laundering operation in an unregistered bank. The Central Bank started proceedings against him, saying that the bank was issuing false money. Finally, the judge agreed that it was a constitutional right of people to have access to finance and that the Central Bank was doing nothing for the poor areas benefiting from the Palmas and he ruled in favour of Banco Palmas.

Timebanks and Mutual Credit

When personal computers emerged in the 1980s so did databases and the ability to create local markets of exchange. Although these systems have been relatively slow to adapt to technological change, they have spread in the developed world where most people have access to computers. The two largest providers are Community Exchange System and Community Forge. Local exchange groups operate either under mutual credit- or timebank principles.

The community-based exchange systems provide the means for communities to trade and exchange their goods and services. They could also be described as a global complementary trading network that operates without money as it is commonly understood. Users have a range of exchange methods for exchanging goods and services: record keeping, organised bartering, swapping, gifting and sharing.

Community Exchange Systems (CES) measure value with Talents, which are directly „backed" by real value in the form of the goods and services that they reflect. The organization says the only real values in the world are the goods and services backing the numbers. No „coin", especially a digital coin, can have value in itself. The CES is purely for facilitating exchange and cannot be used for speculation: „You can only have as much as you give. Everyone has an equal chance".

One of today's most successful ledger technologies, Ripple, was originally developed as OpenCoin by Ryan Fugger in 2004, after he had worked on a local exchange network in Vancouver, Canada. The intent was to create a monetary system that was decentralized and could effectively empower individuals and communities to create their own money. The project was renamed as Ripple Labs in 2015. Ripple is now the largest interbank payment network and is expanding rapidly into developing countries.

A Sovereign Monetary System

"It would be preferable to remove the root-cause of the problems and separate the power to create money from the power to allocate new money. This will effectively reduce the risk and instability of the monetary system, debts will be substantially reduced and the income from creating money will accrue to the state rather than the banks."

- Frosti Sigurjónsson, Prime Minister of Iceland, March 2015

A monetary system is a set of processes and entities involved in providing money to a country's economy. The process of money creation is often misunderstood. One common misconception is that banks act simply as intermediaries, lending out the deposits that savers

place with them. Another common misconception is that the central bank determines the quantity of loans and deposits in the economy by controlling the quantity of central bank money, the so-called „money multiplier" approach. Under the current system money comes into existence as debt (97%).

Due to the severity of the financial crisis in Iceland, the country commissioned KPMG to explore [alternative monetary systems](#) from the money issuance perspective.

Under the proposed Sovereign Monetary System, money would be created by government authority through the central bank. A Monetary Policy Committee (MPC) would be granted the authority to decide on money issuance, with the following options to inject the newly created money into circulation:

- Through the state, which would inject the money into circulation in accordance to the national budget
- Through central bank lending to commercial banks
- Through direct money distribution to citizens.

Concerns about a sovereign monetary system include the fact that monetary financing for government is usually the main cause of runaway inflation. However, the proposed sovereign monetary system keeps the lending business in private hands, but removes the state support and safety nets that banks currently receive, making the system more stable and distributing profits through use of interest payments in government funding.

Many central- and commercial bankers consider the last financial crisis to have been a financial stability problem, to which the money creation question has no relevance. However, money creation and financial stability cannot be separated, as the financial system is the monetary system.

More on the debt issue: [Money Creation and Circulation in a Credit Economy](#)

Cryptocurrency as a Solution

Similar to local tokens and notes financing the industrial revolution, the digital revolution is driven by cryptocurrencies. Bitcoin was introduced at the height of the last financial crisis in 2008. It is a digital coin-based payment system, presented as a counterweight to the fiat debt-based accounting system.

Hundreds of cryptocurrencies have followed and they vary mainly in their consensus algorithms or other technical features such as anonymity of transactions or transaction speeds. Out of all of the projects Ethereum has been able to attract the largest developer community around its smart contracts.

Ethereum does for applications what Bitcoin did for money and payments. With a built-in scripting language and distributed virtual machine, smart contracts can be built to carry out all kinds of functions without the need for a trusted third party or central authority. According to Ethereum, it can be used to "codify, decentralize, secure and trade just about anything."

Cryptocurrency is a mechanism to expand the benefits of the internet into the monetary and payment aspects of society. It is also largely viewed as a mechanism to increase financial inclusion, economic growth, job creation and eradication of poverty. Even mobile money currencies like M-Pesa can be made more efficient and secure when running on a blockchain. An example is Mojaloop Mojaloop is open-source software for financial services companies,

government regulators, and others taking on the challenges of interoperability and financial inclusion. Mojaloop enables sending digital transactions to anyone independent of the service they are using.

Centralization vs. Decentralization

Both Bitcoin and Ethereum mining are very centralized, with the top four miners in Bitcoin and the top three miners in Ethereum controlling more than 50% of the hash rate.

The entire blockchain for both systems is determined by fewer than 20 mining entities. A centralized system with a byzantine quorum consensus algorithm with 30 nodes would be more decentralized than Bitcoin or Ethereum with significantly fewer energy costs.

More importantly than decentralized mining, Ethereum has taken on the task of decentralizing everything. Its Interplanetary File System (IPFS) provides an alternative for the internet and its centralized internet companies, from basic search functions, video sharing platforms and hosting to social media. The system works very well for laptops and tablets, but the 70% of internet users accessing the internet via smartphones cannot yet participate in IPFS.

Furthermore, the Ethereum Enterprise Alliance has developed standards for enterprise applications and use cases. One main development is an open source extension of Ethereum based on these standards, Quorum. It was originally developed for the payment business of JP Morgan and currently 75 banks have joined the network.

Hurdles for Mass Adoption

It is not only the high energy consumption of the Bitcoin network that makes using the currency on a large scale difficult to imagine. As could be witnessed at the beginning of 2018, transaction costs became prohibitely expensive for small amounts when the price of Bitcoin surges. In Ethereum, a user app Cryptokitties almost brought the network to a halt.

Usability is also a key concern for non-technical people. Cryptocurrencies are difficult to understand compared to money as we know it. The technical understanding required to understand how a consensus algorithm works and how public and private keys should be handled, makes the adoption of cryptocurrencies a slow process, possibly excluding large portions of society. Transactions need to be as easy as sending an email.

For the technology itself, scalability is possibly the biggest hurdle for mass adoption. With transaction speeds of around 10 transactions per second cryptocurrencies cannot handle the amount of transactions that for example Visa and Mastercard can (over 300,000 tps). Off-chain solutions are being developed, but central banks can simply order instant payments to fiat currencies and remove interest in using cryptocurrencies for daily payments.

The financial sector and governments are concentrating on bridging the cryptocurrency technology to mass payments through stablecoin projects. These convert 1:1 with fiat currency and the company providing the currency holds the fiat currency in reserve. The largest stable coin is USDTether, but questions have been raised whether their reserve of $1.8 billion is actually there.

A major concern for cryptocurrencies is also coherent regulation or the lack thereof. Taxes, ICOs, exchanges and other areas are handled differently in each country. The only common denominator is that cryptocurrencies are not legal tender. Except in Japan.

Free Electricity in Venezuela

Venezuela is a country that is attempting large-scale adoption of cryptocurrency. After the crash of its economy, many Venezuelans started mining Bitcoin as the country has cheap abundant energy due to government subsidies. At one point it cost 900,000 bolivars - or about $0.90 at the black-market rate - for a coffee, pastry and juice at a cafe, but the monthly electricity, water, gas, internet and phone bills cost only around 300,000 bolivars. Due to hyperinflation these amounts increase on a daily basis in bolivar.

Households can generate around $5 per day mining Bitcoin, which is enough to cover basic needs for many. But more recently the government made it illegal to run a bitcoin or other cryptocurrency rig. As an alternative the state-sponsored, oil-backed cryptocurrency Petro was introduced. Petro is a fork of NEM.

Bloomberg has reported that nearly every home in Caracas operates a Bitcoin mining rig despite the threat of imprisonment. The majority majority of the population has lost trust in the government, the central bank and the banking system.

Central Bank Digital Currency?

Christine Lagarde of the International Monetary Fund has urged the international community to consider endorsing central bank-issued digital currencies: „A system regulated by central banks could become the basis for a rapid expansion of financial services to developing world countries and the poorest people in western societies without the risks associated with privately managed digital currencies".

However, Executive Board Member of the European Central Bank (ECB) Benoit Coeure stated that "there is broad agreement that a central bank digital currency (CBDC), in whatever form, is unlikely to be issued within the next decade".

Private enterprise has a different standpoint. Stanley Yong of IBM's Blockchain for Financial Services stated that CBDCs are „the only way to mitigate the kinds of risks that came about during the Lehman crisis of 2008", and could specifically „prevent a settlement system freeze – a systemic failure that affected financial systems across multiple countries during the Lehman fallout".

In the public sector, for example the United Nations is exploring the idea of using blockchain technology to provide legal identification to over one billion people without any authorized documents and the World Food Program is using cryptocurrency for payments to 500,000 refugees.

Estonia is perhaps the most advanced nation adopting blockchain technology. With its XRoad project, Estonia has moved most of public services on to the blockchain and has created a legal framwork for the use of cryptocurrency as legal tender. The country has proposed its framework can be deployed by other countries also. The latest development is national ID cards that have an integrated Ethereum wallet.

Along these lines, the Mayor of Naples, Luigi de Magistris, has posted a pledge to launch an autonomous municipal cryptocurrency on his Facebook public profile. The cryptocurrency „would unshackle the city from anti-southern discrimination and unfair debt" and would be part of a threefold plan of action that would reclaim political and fiscal autonomy for Naples.

OecoSystema

Overview

OecoSystema provides a marketplace for the exchange of goods and services for low-income people. A fairly distributed ECOS utility token for payment overcomes the lack of money in the economies of the poor. Users cooperate on a local level to save money, share value and create a stronger community with improved quality of life. Each user receives 50 ECOS tokens for payment in the marketplace.

OecoSystema enables both smartphone transactions through the app's wallet, as well as SMS transactions with cellphones. The technology is simplified, so users do not need to understand the underlying cryptography. With approximately 50% of people in developing countries having a cellphone, the potential user base of OecoSystema is greatly expanded by enabling SMS transactions.

Smartphone users post offers, communicate and conduct transactions through an Android application. As smartphone prices go down, the amount of users goes up and more people can upgrade from a cellphone to a smartphone. The cheapest smartphones are currently priced at around $20. In India for example, a railway porter who earns $8 a day can buy a low-end smartphone and use WiFi for free at work or a restricted data plan at home.

Cellphone users can join the network through a network of local agents and conduct their transactions with SMS. The local agents process cellphone user identification and registration. A local agent can earn money selling a transaction token required for the SMS transactions, while educating and supporting users. Physical village markets can be organized for the exchange of goods and services where the local agent acts as an organizer. Offers can be posted on to a chalk board or in a community center. This is similar to Alfred Sirleaf publishing his local Daily Talk news on the streets in Liberia, where people cannot afford to buy a newspaper.

ERC20 Tokens

OecoSystema runs on a private Ethereum network with two ERC20 tokens, a fairly distributed utility token ECOS for exchanging goods and services, and a transaction token TX for paying SMS transactions. A finance token OECO runs on the Ethereum Mainnet and enables the project development while participating in the growth of the network through ECOS tokens.

Each user who joins the network receives 50 ECOS utility tokens for the marketplace. In addition, 5 ECOS per user are minted. 2.5 ECOS are rewarded through a friend referral program to the user that invited the new user and 2.5 ECOS are rewarded to holders of OECO.

OECO Finance Token

OECO is an ERC20 token on the Ethereum Mainnet.

Symbol: OECO
Contract: 0xd111d90e8ac1989c7af2e30018a367305924d130
Max supply: 1,000,000 OECO

Each OECO token receives 0.0000025 ECOS per user, i.e. per 1 million users, each OECO token receives 2.5 ECOS tokens.

ECOS Utility Token

ECOS utility tokens are ERC20 tokens on the OecoSystema private Ethereum network.

Symbol: ECOS
Max supply: (50+5) ECOS x amount of users
Initial supply: 0 ECOS

The OecoSystema network itself does not have a native token. The ECOS token is created on the network through the ERC20 interface. Each user receives 50 ECOS upon joining the network. ECOS has no initial supply and it is minted as users join the network. ECOS is used as a measure of value in the network, reflecting the value users exchange in the marketplace for goods and services. In addition 5 ECOS per user are minted. The referring user (friend referral) receives 2.5 ECOS. A further 2.5 ECOS are rewarded to holders of OECO tokens.

The marketplace has a user fee of 1 ECOS per month for posting and reading offers. The sending and receiving of transactions remains free of charge at all times and does not require a subscription to the marketplace application.

Token balances are displayed with 2 decimals, similar to the fiat money in use: 50.00 ECOS.

TX Transaction Token

TX is an ERC20 token on the OecoSystema private Ethereum network.

Symbol: TX
Max supply: amount of transactions on the OecoSystema network
Initial supply: 0 TX

TX is minted as required by the users and the network of local agents of OecoSystema. TX is purchased from the company OecoSystema for ETH (Ethereum) or Bitcoin. TX covers transaction costs of SMS transactions. When the user completes a transaction, the TX returns to the company OecoSystema and is burnt.

The cost of one TX to the user is $0.05. Local agents can purchase TX tokens from the company at a price of $0.025 per TX.

Blockchain & User Identification

OecoSystema is built on Quorum, which is an extension of go-Ethereum originally developed for the payment business of JP Morgan. Quorum enables a private state and a public state of the ledger to be derived from a single, shared, complete blockchain of transactions validated by every node in the network.

OecoSystema Quorum

*Definition Quorum: „A **quorum** is the minimum number of votes that a distributed transaction has to obtain in order to be allowed to perform an operation in a distributed system. A **quorum**-based technique is implemented to enforce consistent operation in a distributed system". -Wikipedia*

At the blockchain level, Quorum consists of the Constellation Network and the Public go-Ethereum Nodes. The Enclave in Constellation is a Zero-knowledge Security Layer that allows for cryptographically assured, private settlement of digitized tokens on Quorum.
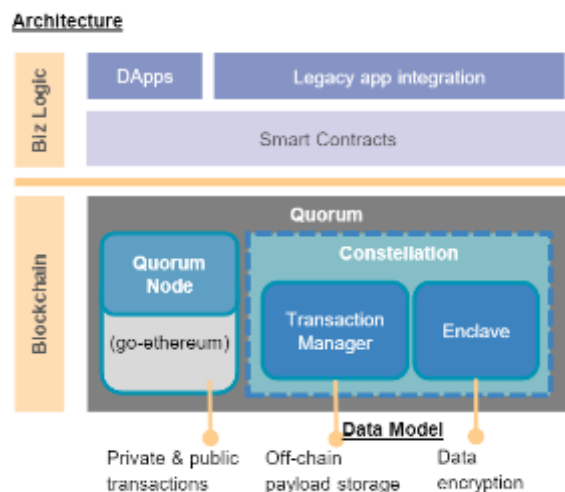
Quorum networks process up to 100 transactions per second, depending on how the network and smart contracts are configured. The blockchain has a private and public state. Transactions are published privately in an unconfirmed state and are only final if their transaction hashes are confirmed on the public blockchain state. A regulator node has all the data as it must be part of every private transaction.

OecoSystema Quorum may allow independent regional tokens to join the Quorum later and issue their own regional currencies, while strengthening the OecoSystema Quorum.

Rather than proof-of-work (mining), Quorum uses the vote-based QuorumChain, RAFT. Raft achieves consensus via an elected leader. A server in a raft cluster is either a *leader* or a *follower*, and can be a *candidate* in the precise case of an election (leader unavailable). The leader is responsible for log replication to the followers. It regularly informs the followers of its existence by sending a heartbeat message. Each follower has a timeout (typically between 150 and 300 ms) in which it expects the heartbeat from the leader. The timeout is reset on receiving the heartbeat. If no heartbeat is received the follower changes its status to candidate and starts a leader election.

Initially, OecoSystema has 5 nodes processing transactions and 2 watcher nodes storing the ledger only. In case of network failure the blockchain can be restarted with the leader node and one watcher node. External watcher nodes are established for further security.

OecoSystema node clusters are run on enterprise-level infrastructure and the public state of the ledger relays to Ethereum Mainnet every six hours (i.e. a hash of the network's state is published on Ethereum Mainnet).

User Identification and Transactions

User identification and transactions differ for smartphone and cellphone users. The user experience for both will be as easy as sending a text message, although more convenient on a smartphone.

Registration of all users is done by 3D facial recognition and authentication. The user's biometric facial ID is the private key of their account. In case of phone loss, the user's account can be recovered with facial authentication (private key).

User accounts are mapped to the users' chosen usernames. These usernames are visible to all users in the app and transactions are conducted with usernames or QR codes only. An additional app password is required for signing transactions.

Cellphone users are identified by local agents who take a picture of the user and send it to the company OecoSystema together with the user's mobile number. The user receives a confirmation SMS with their account balance (50 ECOS/0 TX). Users can purchase TX tokens from local agents. The cost of one TX is $0.05.

SMS transactions are written directly on to the OecoSystema Quorum once received through an SMS Gateway API. SMS transactions are processed by a smart contract deployed on the OecoSystema Quorum. The confirmed transactions are then communicated to the sender and recipient of the transaction:

- A user sends an SMS to a dedicated number in the following form: <x> ECOS to <phone number>
- The sender then receives an SMS from the system: <x> ECOS sent to <phone number>. Your new balance is <x> ECOS / <x> TX
- The recipient receives an SMS from the system: <x> ECOS received from <phone number>. Your new balance is <x> ECOS / <x> TX.

Scaling Solution

With a population of 50 million in Kenya, M-Pesa processed 500 million transactions in 2016. With a transaction speed of and 15 transactions per second on Ethereum and 7 tps on Bitcoin, the Ethereum Mainnet could have handled the M-Pesa transactions in 2016, but nothing else. Visa and Mastercard have a capacity of over 300,000 tps.

For scaling, even the 100 tps provided by Quorum is not sufficient. The only way to scale is to move transactions off-chain with a safe mechanism. For Ethereum, the off-chain scaling solutions are Plasma and the Raiden Network. Plasma has a live production solution with Loom Network's DappChains integration of Plasma Cash. Loom is currently focussing on computer game assets, but the technology is suitable for closed payment networks also.

A DappChain is a Layer 2 blockchain that uses Ethereum as its base layer. The consensus algorithm and rule sets can be customized to meet the requirements relating to scalability and security tradeoffs of the Dapp. The first version of DappChains can handle 10,000 transactions per second.

In DappChains:

- Each token receives a unique serial number similar to fiat currency notes today
- Zero confirmation transactions are enabled by keeping everything in memory with the core transaction logic as a single thread
- The cryptographic operations (hashes and signatures) are kept out of the core transaction logic
- The DappChains periodically report Merkle Proofs acting as checkpoints to the OecoSystema Quorum, which relays to the Ethereum Mainnet every 6 hours.

Marketplace and Payment Network

Introducing a payment network to developing markets is a challenging task. Currently there is no complete payment system for micro payments across developing countries due to the lack of bank accounts and credit cards. Peer-to-peer cryptocurrency projects are emerging, but most are built on the leading cryptocurrencies with limitations to scalability and focus on countries with strong economic growth. High transaction costs also effect adoption of major cryptocurrencies. The least developed countries also often have high prices for mobile communications and disadvantegous direct carrier billing and premium SMS pricing- and revenue share models. High prices for SMS messages is also an issue for users in some regions.

OecoSystema overcomes these hurdles by introducing its own network of local agents with the ability to collect micropayments from users, while creating jobs and securing local support for users.

Marketplace Application

The marketplace application is a progressive web app and designed for use on 2G networks, providing slow internet speeds and consuming small amounts of data. The offers can be displayed as text-based only, allowing for fast searches and functionality with low bandwidth. The app can function on a throttled 32 kbps internet connection, which is useful if the user does not have access to a data plan at all times.

The marketplace allows the exchange of goods and services. A focus is on the exchange of food, neighborhood help, ride sharing, clothes and other items of necessity. For example, a farmer can ask for help before the harvest season and pay with ECOS, later sharing the harvest by accepting ECOS as payment.

The ECOS tokens can be exchanged on a peer-to-peer exchange for ETH/Bitcoin or cash. In markets like Venezuela, ECOS tokens can help overcome the difficulties imposed by hyperinflation to the exchange of goods. If half a loaf of bread is valued at 1 ECOS today, it will be around the same price in ECOS tomorrow.

The marketplace application has a simplified sign-up process as well as user experience. Users are not required to understand the underlying cryptography to use the marketplace.

Fees and Payments

The TX tokens are purchased from the OecoSystema company at a price of $0.025 each in ETH or Bitcoin. Local agents sell TX tokens to users for $0.05.

- The marketplace app has a monthly subscription fee of 1 ECOS
- To the users SMS transactions cost $0.05 or 1 TX each (countries with high SMS costs may have a price of 2 TX).

The TX token is minted as local agents purchase it. As users pay transactions with TX, the token returns to OecoSystema and is burnt.

The peer-to-peer exchange for ECOS tokens is based on atomic swaps with no transaction fees, except Bitcoin/Ethereum charges.

Local Agents as Intermediaries

The adoption of the marketplace app and especially the SMS transactions requires local marketing and support efforts. A local agent acts as an intermediary and earns a living supporting the users by:

- Marketing the ECOS marketplace and conducting user acquisition
- Educating users on how to use the marketplace and the tokens
- Creating a business selling TX tokens to users for cash

In addition to earning $0.025 per TX token, local agents also receive 2.5 ECOS per cellphone user they register, as in the friend referral program applicable to all smartphone users.

In order to ensure the integrity of users, OecoSystema requires registration of local agents with identification. A separate app is provided to local agents to conduct their business. The agent application is integrated with localbitoins.com and localethereum.com, so local agents can acquire ETH/Bitcoin and efficiently purchase TX tokens from the company OecoSystema. At the same time the local agents of OecoSystema expand the peer-to-peer exchange networks of ETH/Bitcoin.

Regulatory Assessment

Regulation of cryptocurrencies focuses mainly on five areas: anti-money laundering and anti-terror financing laws, know-your-customer, exchange trading and ICOs as well as application of tax laws.

The library of the US Congress has gathered the relevant regulations for most countries in the world. Read here.

AML/KYC

Mobile money operators have to comply with Know Your Customer (KYC) requirements and follow best practice both to ensure the commercial reliability of the financial services as well as to comply with financial regulators' rules on KYC, particularly for the purposes of anti-money laundering (AML) and counter financing of terrorism (CFT) policies. KYC identification requirements for financial services are imposed by central banks and finance ministries due to the handling of customer funds (legal tender).

Anti-money laundering and know your customer legislation is being implemented for cryptocurrency exchanges worldwide also. The laws generally provide a limit of around $150 for transacting without identification, but many exchanges require identification for all transactions.

Registering a SIM card requires mandatory ID verification in most developing countries. However, identification systems are at development stage and in most cases operators are not able to check the validity against a government ID database. For example in India the new Aadhar identification number is required for SIM card registration and there can be 9 simultaneously active SIM cards for each Aadhar number.

OecoSystema stores users' mobile numbers as these are required for SMS transactions. Local agents are required to submit proof of identity in order to meet KYC legislation and to establish trust, as local agents act as intermediaries on behalf of OecoSystema and its users.

All exchanges on OecoSystema between ECOS regional tokens, TX tokens and other

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cryptocurrencies are conducted as peer-to-peer atomic swaps, or in the case of TX tokens being sold by local agents to users, in a registered token for cash transaction.

Taxation

Similar to community exchange systems (CES), OecoSystema is not a scheme for avoiding the payment of taxes. The goods and services provided on the OecoSystema marketplaces are not tax exempt, rather they have either been taxed already as used goods or in case of services, are considered neighborly help. There are numerous legal precedents for this classification.

In a number of countries, various government taxation authorities have examined CES along with other forms of counter trade, and made rulings concerning their use. Generally for personal arrangements, social arrangements or hobbies, there are no taxation implications. This generally covers the vast majority of CES transactions. Taxation liabilities accrue when a tradesperson or professional person provides his or her professional services in payment for CES units, or a registered or incorporated business sells part of its product for CES units. In such cases, the businesses are generally encouraged to sell the service or product partly for CES units and partly in the national currency, to allow the payment of all required taxation. This does imply, however, that in situations where national currency expenditures would be tax-deductible, CES must be as well.

OecoSystema does not support the trade of professional goods or services. In cases where a farmer for example requests help from villagers, these activities are to be conducted as small scale community supported agriculture. Should the need arise, OecoSystema can provide an additional app to professional sales people for accounting and VAT purposes.